Thesis Portfolio

Human-Powered, Illuminated Runner's Vest

(Technical Report)

How the Lack of a 50th Percentile Female Crash Dummy Affects Female Drivers

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

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Spring, 2020

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Sociotechnical Synthesis

Introduction

Currently in the United States, there about 114 million licensed female drivers, and 111.5 million male drivers with an average of 1.88 vehicles per U.S. household (Statista, 2017 & 2019). Cars are also in the midst of an automation overhaul as automated car ventures are pursed by Tesla, Google, Mercedes-Benz, GM, Volvo, Toyota, and many more companies. As new advancements come out for vehicular transport, car safety has to be considered and designed for along with any other changes made. Even with all of the buzz around car technology, a critical disparity in car safety between males and females has been ignored and pushed aside by media, manufacturers, and regulators.

Women are actively being discriminated against by governmental regulations on car safety. Even after close to 80 years with car crash dummies, only one of the three adult dummies used by the National Highway Traffic Safety Administration is female, and it only represents a fifth percentile stature female. With over 30,000 motor vehicle crash deaths every year, car crashes are a pressing problem with actively occurring consequences (CDC, 2017). Vehicular collisions present another issue as well, over 5,000 pedestrians were killed by traffic crashes in the United States, and 129,000 were treated for non-fatal injuries in 2015 (CDC, 2017).

In the Technical Research Capstone, a human-powered LED jogging vest was designed and created for its ability to provide greater safety for pedestrians and reduce their energy consumption. In the STS Research Paper, the effect of the lack of an average female car crash dummy on car safety is researched and discussed through the lens of Actor Network Theory. These projects overlap not only by both regarding car safety, but the projects both place focus on the users of these technologies and how to better protect them. Regardless of money spent,

research conducted, or any other metric, the people, regardless of gender, class, race, or ability, remain the most important actors and deserve the highest priority consideration for car and pedestrian safety.

Human-Powered, Illuminated Runner's Vest

In order to harness pedestrian mechanical energy from motion and provide better safety for users, a self-powered light-up jogging vest has been designed and manufactured. This vest consists of the fabric itself, two linear generators (these convert movement into electrical energy), and four LED strips lining the fabric. Since the vest relies on linear generators for power, there is no need for a battery, and the vest, unless broken, can be used indefinitely simply by swapping out LED's if they burn out.

Currently, illuminated jogging vests sell from anywhere between $15 to $60 on the market. The goal for the technical project is to completely produce the device for under $50. A prototype was designed and tested to complete a full proof-of-concept. While work remains to finalize the design for mass production at the lowest cost, the concept, design, and execution has been completed.

How the Lack of a 50th Percentile Female Crash Dummy Affects Female Drivers

Currently, three adult dummies are used for crash testing by the National Highway Traffic Safety Administration (NHTSA): the HYBRID III 5th Percentile Female, HYBRID III 50th Percentile Male, and HYBRID III 95th Percentile Male. These dummies are supposed to represent the average physical characteristics of the general U.S. population to ensure that cars they are tested in are safe for their target demographic. The results of car safety tests are published by NHTSA and car manufacturers to inform the public. It is impossible, however, for

these dummies to accurately represent the population at large due to the lack of a 50th percentile female dummy.

In the STS analysis, Actor Network Theory is utilized to evaluate the relationships and inherent power dynamics between car manufacturers, crash dummies, and car occupants of both sexes. Background research, case studies, and expert interviews are incorporated to shed light on the difference that sex makes on car occupant response in crashes as well as the relationship between manufacturers, safety testing, and legal requirements. This paper will provide urgent information for female car occupants and drivers to raise awareness regarding differential protection between males and females in cars and what can be done to rectify this.

Reflection

Through working on both the self-powered illuminated vest as well as the STS analysis of female crash dummy impact, I was able to better understand the wealth of car safety issues and their complications. In addition, it forced me to consider a range of impact positions from car to car, car to object, and car to pedestrian, as well as what road conditions surround that such as blind turns, dimly lit conditions, and intersections. The STS paper is anchored by a lack of consideration of female anatomical and biological differences from males in crash dummy design and testing. Through designing the vest, my team had to consider consumers of a variety of gender, body type, height, etc. to find a placing for the linear generators as well as sizing for the vest. Overall, these projects work simultaneously to reinforce how every person needs to be considered in object design, not just the average male.

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